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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/713,830

11/15/2000

Toshiharu Furukawa

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06/18/2004

IBM Corporation  
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EXAMINER

QUINTO, KEVIN V

ART UNIT

PAPER NUMBER

2826

DATE MAILED: 06/18/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No. 09/713,830	Applicant(s) FURUKAWA ET AL.	
	Examiner Kevin Quinto	Art Unit 2826	

-- The MAILING DATE of this communication appears on the cover sheet with the corresponding address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 02 February 2004.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 10, 12-20 and 45-47 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 10, 12-20, and 45-47 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Response to Arguments***

Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn.

Applicant's arguments with respect to claims 10, 12-20, and 45-47 have been considered but are moot in view of the new ground(s) of rejection.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. Claims 10, 12, 16, 19, 20, and 45-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin et al. (USPN 6,124,177).
2. In reference to claim 20, Lin et al. (USPN 6,124,177, hereinafter referred to as the "Lin" reference) discloses a similar device. Figure 8 of Lin illustrates a FET with a gate (22, 32) comprising a first conductive material (22) and a second conductive material (32). The second conductive material (32) is a silicide. This is different from the first conductive material (22) which is polysilicon. The second conductive material (32) extends beyond the first conductive material (22) to form a T-shaped gate. There is a first diffusion region (25) which is self-aligned to the first conductive material (22).

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There is a second diffusion region (24) which is defined by the second conductive material (32). There is a spacer (not labeled) which is along the sidewalls of the second conductive material (32). A third implant region (30) is defined by the spacer. An air gap is left behind the spacer along a notched sidewall of the first conductive material (22). With regard to claim 20, Lin teaches all of the claimed invention except for the thickness of the second conductive material. Although the Lin device does not teach the exact thickness as that claimed by Applicant:

The shape, size, dimension differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416.

In addition:

Note that the specification contains no disclosure of either the critical nature of the claimed dimensions or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Therefore claim 20 is not patentably distinguishable over the Lin reference.

3. In reference to claim 10, the first conductive material (22) is on a gate dielectric (20). The gate dielectric (20) is on a substrate (10).
4. In reference to claims 12 and 16, the first conductive material (22) is polysilicon, thus comprising a first semiconductor material.
5. In reference to claim 19, the second conductive material (22) is a silicide.
3. In reference to claim 46, Lin discloses a similar device. Figure 8 illustrates FET with a gate (22, 32) disposed on a substrate (10). The gate (22, 32) has a lower portion (22) having first sidewalls and an upper portion (32) having second sidewalls. The sidewalls are laterally offset. There are spacers (not labeled) disposed on the second sidewalls which extend down to the substrate (10) without contacting the first sidewalls

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to define an air gap (28). There is a first implant region (25) in the substrate (10) which is aligned to the first sidewalls and a second implant region (24) which is aligned to the second sidewalls. The first implant region (25) and the second implant region (24) are offset by a distance equal to about the lateral offset distance between the first and second sidewalls. Lin teaches all of the claimed invention except for the thickness of the second sidewall. Although the Lin device does not teach the exact thickness as that claimed by Applicant:

The shape, size, dimension differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416.

In addition:

Note that the specification contains no disclosure of either the critical nature of the claimed dimensions or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Therefore claim 46 is not patentably distinguishable over the Lin reference.

6. With regard to claim 45, the upper portion (32) of the gate extends beyond the lower portion (22) thereby forming a T-shaped gate.
7. With regard to claim 47, there is a third implant (30) which is aligned to the spacers.
8. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lin et al. (USPN 6,124,177) in view of Sagnes (USPN 5,998,289).
9. In reference to claim 13, Lin does not disclose the use of germanium as a material in the gate electrode. However the use of germanium as a gate electrode is well known in the art. Sagnes (USPN 5,998,289) discloses that using germanium in the gate electrode provides the benefit of compatibility with both n and p type transistors

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which leads to a more efficient fabrication process (column 1, lines 26-32). It would therefore be obvious to utilize germanium in the gate electrode of Lin in order to attain this benefit.

10. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lin et al. (USPN 6,124,177) in view of Naruse et al. (USPN 5,356,821).

11. In reference to claim 14, Lin does not disclose the use of a germanium compound ( $\text{Ge}_x\text{Si}_{1-x}$  with  $0.5 < x < 1.0$ ) as a material in the gate electrode. However the use of a germanium compound ( $\text{Ge}_x\text{Si}_{1-x}$ ) as a gate electrode is well known in the art. Naruse et al. (USPN 5,356,821, hereinafter referred to as the "Naruse" reference) discloses that using a germanium compound ( $\text{Si}_{1-x}\text{Ge}_x$ ) in the gate electrode provides the benefit of lower resistance (column 7, lines 18-29). Naruse discloses an example where  $x = 0.52$  (column 7, lines 18-21); thus meeting the limitation where  $0.5 < x < 1.0$ . Naruse also discloses that as germanium content increases, the resistance decreases (column 7, lines 22-25). It would therefore be obvious to utilize a germanium compound ( $\text{Ge}_x\text{Si}_{1-x}$  where  $0.5 < x < 1.0$ ) in the gate electrode of Lin in order to attain the benefit of lower resistance.

12. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lin et al. (USPN 6,124,177) in view of Price et al. (USPN 4,570,328).

13. In reference to claim 15, Lin does not disclose the use of polysilicon as the second conductive material in the gate electrode. However the use of polysilicon as material in a gate electrode is well known in the art. Price et al. (USPN 4,570,328, hereinafter referred to as the "Price" reference) discloses that using polysilicon in the

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gate electrode provides the benefit of compatibility with the high temperature processes which take place after the electrode and interconnect fabrication (column 1, lines 19-34). It would therefore be obvious to utilize polysilicon as the second conductive material in the gate electrode of Lin in order to attain this benefit.

14. Claims 17 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin et al. (USPN 6,124,177) in view of Rodder (USPN 6,087,248).

15. In reference to claims 17 and 18, Lin does not disclose the use of a refractory metal as the second conductive material in the gate electrode. However the use of a refractory metal as material in a gate electrode is well known in the art. Rodder (USPN 6,087,248) discloses that using a refractory metal such as tungsten in the gate electrode provides the benefit of being able to withstand the later high temperature processes (column 4, lines 32-38). It would therefore be obvious to utilize a refractory metal, such as tungsten, as the second conductive material in the gate electrode of Lin in order to attain this benefit.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Quinto whose telephone number is (571) 272-1920. The examiner can normally be reached on M-F 8AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn can be reached on (571) 272-1915. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KVQ

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